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Equipment Condition Report

Overall Diagnosis
CRITICAL

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Machine ID:	**Flag Gangos - Pump 1 - STBD**	Product (h/km):		Lab Sample N°:	**GP894**
Application:	**Hydr system**	Machine (h/km):		Label N°:	
Make/Type:		Filter (h/km):		Equipment Ref. N°:	**LGP657**
Cust. Order N°:		System (l):		Sample Taken:	29/10/2014
Product:	Shell Tellus T 32	Top-up (l):		Sample Received:	03/11/2014

GP894
29/10/2014
CRITICAL

Reported Maintenance:

No maintenance actions mentioned.

Comments Oil Condition:

Visual aspect: dark yellow coloured, turbid, with visual foreign matter.
The water content is not significant: 45 ppm.
The kinematic viscosity @40°C, 32.16 mm²/s, complies with the mentioned ISO VG32 specification limit.
The kinematic viscosity @50°C is 22.32 mm²/s
The kinematic viscosity @60°C is 16.17 mm²/s
The kinematic viscosity @70°C is 12.16 mm²/s
The kinematic viscosity @100°C is 6.10 mm²/s
The oil's acidity is considered acceptable for this application: 0.44 mgKOH/g.
The ICP spectrometry reveals 37 ppm copper, 15 ppm lead, 14 ppm tin and 9 ppm iron.

Comments Machine Condition:

The WPC is used to establish a wear baseline because the WPC remains more or less the same from sample to sample over a period of time as long as a machine is operating normally. The current WPC, 339 is difficult to diagnose without historical data, but is too high though for a hydraulic system.
The microscopic evaluation of the ferrogram shows that the ferrous wear primordially consists of small rubbing wear platelets, <15 µm. The larger ferrous wear particles are abrasive wear, fatigue chunks and flakes with a maximal diameter of respectively 30 µm, 25 µm and 25 µm. Heat treatment reveals that 85% of the ferrous wear particles are low alloy steel.The presence of oxides is notable. They are abrasive and can have a negative influence on the wear mode.
The non-magnetic wear particles observed are small, <15 µm, blank metal particles.
The amount of pollutants is huge with mostly fine crystalline particles such as sand/dust and silt.

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Recommendations:

Without historical data it is difficult to give adequate recommendations, but based on current analysis results we consider the overall condition cautiously as CRITICAL.
Keep under close observation.
It is recommended that this unit is checked for any unusual operating conditions. Monitor temperatures, pressures, noises, filtration, ... as applicable.
We recommend the efficiency of the system filter is checked.
A preventive oil change is advised. Check th erecommendations of the manufacturer concerning oil change.
Ensure representative sampling of the system.

Sample Reported: 06/11/2014 Hilde Lecluyse

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Test Name	Method	Unit	Results
			GP894
PHYSICAL-CHEMICAL ANALYSIS			
Colour	ASTM-D1500	-	**2.5**
Visual appearance	OMS 13882	-	**turbid**
Determination of water (KF)	ASTM-D6304	ppm	**45**
Kinematic Viscosity @40°C	ASTM-D445	mm²/s	**32.16**
Kinematic Viscosity @100°C	ASTM-D445	mm²/s	**6.102**
Acid Number (AN)	ASTM-D664	mg KOH/g	**0.44**
PQ - Wear index	OMS 14406	-	
ELEMENTAL ANALYSIS			
Aluminium (Al)	ASTM-D5185	ppm	**0**
Barium (Ba)	ASTM-D5185	ppm	**0**
Calcium (Ca)	ASTM-D5185	ppm	**46**
Chromium (Cr)	ASTM-D5185	ppm	**0**
Copper (Cu)	ASTM-D5185	ppm	**37**
Iron (Fe)	ASTM-D5185	ppm	**9**
Magnesium (Mg)	ASTM-D5185	ppm	**26**
Molybdenum (Mo)	ASTM-D5185	ppm	**11**
Sodium (Na)	ASTM-D5185	ppm	**5**
Nickel (Ni)	ASTM-D5185	ppm	**1**
Phosphorus (P)	ASTM-D5185	ppm	**300**
Lead (Pb)	ASTM-D5185	ppm	**15**
Silicon (Si)	ASTM-D5185	ppm	**0**
Tin (Sn)	ASTM-D5185	ppm	**14**
Zinc (Zn)	ASTM-D5185	ppm	**270**
Potassium (K)	ASTM-D5185	ppm	**0**
WEAR INDEX			
Optical density - large	OMS 13875	-	**272.0**
Optical density - small	OMS 13875	-	**67.0**
WPC - Wear Index	OMS 13875	-	**339.0**
% Large particles	OMS 13875	%	**60**
ANALYTICAL FERROGRAPHY			
FERROUS			
Normal rubbing wear (FW-NR)	ASTM-D7690	µm max.	**< 15**
Severe sliding wear (FW-SS)	ASTM-D7690	µm max.	
Abrasive wear (FW-AW)	ASTM-D7690	µm max.	**30**
Fatigue chunks (FW-FC)	ASTM-D7690	µm max.	**25**
Fatigue flakes (FW-FF)	ASTM-D7690	µm max.	**25**
Spheres (FW-S)	ASTM-D7690	µm max.	
Dark oxides index (FW-DOI)	ASTM-D7690	-	**5**
Red oxides - Rust index (FW-ROI)	ASTM-D7690	-	**3**
Corrosive wear (FW-Cor)	ASTM-D7690	µm max.	**< 1**
Ferrous wear - Severity index (FW-SI)	ASTM-D7690	-	**6**
NON-FERROUS			
White metal alloy wear (NFW-WM)	ASTM-D7690	µm max.	**< 15**
White metal - Severity index (NFW-WMI)	ASTM-D7690	-	**3**
Copper alloy wear (NFW-Cu)	ASTM-D7690	µm max.	
Copper alloy index (NFW-CuI)	ASTM-D7690	-	
Non ferrous - Severity index (NFW-SI)	ASTM-D7690	-	**3**
CONTAMINANTS			
Crystalline particles index (Con-CPI)	ASTM-D7690	-	**6**
Amorphous particle index (Con-API)	ASTM-D7690	-	**2**
Friction polymer severity index (Con-FPI)	ASTM-D7690	-	**2**
Fibres - Severity index (Con-FibI)	ASTM-D7690	-	**2**
Other contaminants index (Con-OCI)	ASTM-D7690	-	**3**

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Test Name	Method	Unit	Results
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Contamination severity index (Con-SI)	ASTM-D7690	-	**6**

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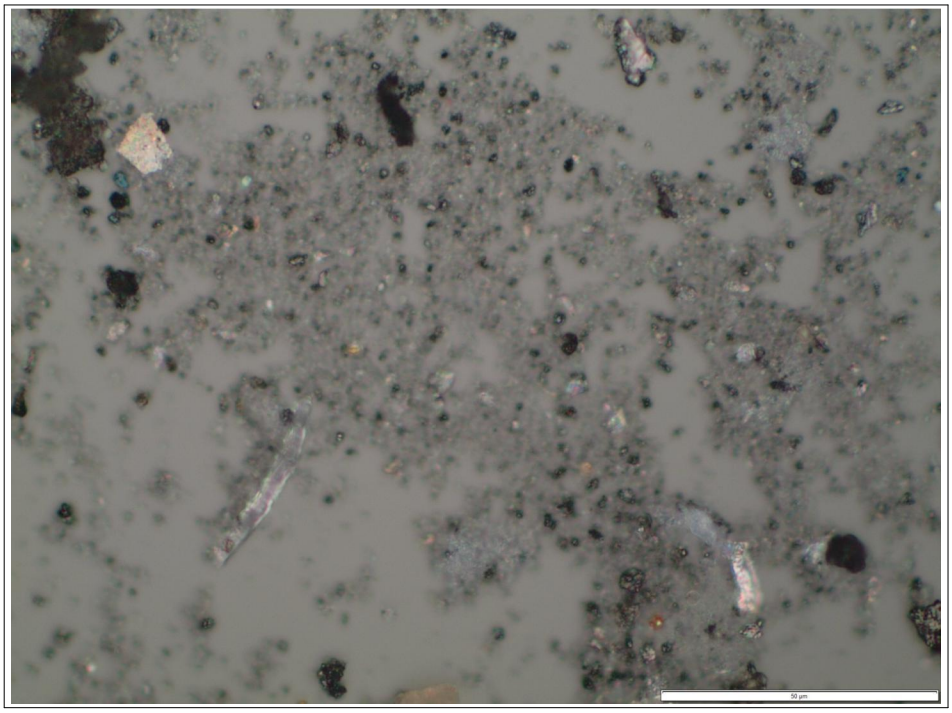

Notable amount of abrasive material such as oxides, sand/dust and silt.